UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/534,899	06/27/2012	Jason Z. LIN	10011.011900 (P3677)	2474

61506 7590 01/27/2017

OKAMOTO & BENEDICTO LLP
P.O. BOX 641330
SAN JOSE, CA 95164

EXAMINER	
BEASLEY, DEIRDRE L	

ART UNIT	PAPER NUMBER
2482	

MAIL DATE	DELIVERY MODE
01/27/2017	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JASON Z. LIN

Appeal 2016-004746
Application 13/534,899[1]
Technology Center 2400

Before CARLA M. KRIVAK, HUNG H. BUI, and
JEFFREY A. STEPHENS, *Administrative Patent Judges*.

BUI, *Administrative Patent Judge.*

DECISION ON APPEAL

Appellant seeks our review under 35 U.S.C. § 134(a) of the Examiner's Final Rejection of claims 1, 4–10, and 13–20, which are all of the claims pending on appeal. We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.[2]

---

[1] According to Appellant, the real party in interest is KLA-Tencor Corporation. App. Br. 2.

[2] Our Decision refers to Appellant's Appeal Brief, filed September 10, 2015 ("App. Br."); the Reply Brief, filed March 31, 2016 ("Reply Br."); the Examiner's Answer, mailed February 12, 2016 ("Ans."); the Final Office Action, mailed April 15, 2015 ("Final Act."); and the original Specification, filed June 27, 2012 ("Spec.").

STATEMENT OF THE CASE

Appellant's invention relates to a method and apparatus for wafer and reticle inspection to detect defects on substrates. Spec. 1:10–11; Abstract.

Claims 1, 10, and 19 are independent. Representative claim 1 is reproduced below with disputed limitations in *italics*:

> 1. An apparatus for detecting defects on a manufactured substrate, the apparatus comprising:
>
> an imaging tool arranged to obtain image frames from the manufactured substrate; and
>
> a data processing system including a processor, memory and computer-readable code in said memory, the computer-readable code being configured to
>
> compute features for pixels in an image frame;
>
> use the features computed for the pixels in the image frame to separate pixels belonging to a feature-defined group of pixels from other pixels in the image frame that do not belong to the feature-defined group of pixels;
>
> *generate a multi-dimensional feature distribution for only pixels belonging to the feature-defined group of pixels;*
>
> *determine a normal cluster in the multi-dimensional feature distribution; and*
>
> *detect outlier points in the multi-dimensional feature distribution which are outside the normal cluster.*

App. Br. 14–18 (Claims Appendix).

Examiner's Rejection and Reference

Claims 1, 4–10, and 13–20 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Noy (US 7,127,099 B2; issued Oct. 24, 2006). Final Act. 5–8.

Issue on Appeal

Based on Appellant's arguments, the dispositive issue on appeal is whether Noy discloses several limitations of independent claim 1, and similarly independent claims 10 and 19, including:

> "generate a multi-dimensional feature distribution for only pixels belonging to the feature-defined group of pixels;
>
> determine a normal cluster in the multi-dimensional feature distribution; and
>
> detect outlier points in the multi-dimensional feature distribution which are outside the normal cluster."

App. Br. 7–12; Reply Br. 2–6.

ANALYSIS

Independent claims 1, 10, and 19 require: (1) a multi-dimensional feature distribution generated for *only pixels* belonging to a feature-defined group of pixels; and (2) determining a normal cluster and detecting outlier points in such multi-dimensional feature distribution. App. Br. 14, 16, 18.

In support of the anticipation rejection of claim 1, and similarly claims 10 and 19, the Examiner finds Noy discloses Appellant's multi-dimensional feature distribution, normal cluster, and outlier points. Final Act. 3–5 (citing Noy 4:1–9, 6:66–7:3; Figs. 1, 4C, and 4D). Particularly, the Examiner finds Noy extracts representative features for an image frame and generates multi-dimensional images of separated non-defective and defective features, thereby teaching a multi-dimensional feature distribution generated for only pixels belonging to a feature-defined group of pixels, as claimed. Final Act. 3, 5 (citing Noy 6:66–7:3; Fig.1, blocks 20 and 28). The Examiner also

finds Noy's reference images of non-defective features teach normal clusters, and Noy's remaining defective features teach outlier points. Final Act. 3, 5 (citing Noy Fig.1, blocks 24, 26, 28, 30).

Appellant argues Noy does not generate a multi-dimensional feature distribution for only pixels belonging to a feature-defined group of pixels, as recited in claim 1. App. Br. 9; Reply Br. 2–3. According to Appellant, Noy's multi-dimensional images "are simply two-dimensional images, not multi-dimensional feature distributions" as claimed because Noy's two-dimensional images do not form "a feature distribution based on only pixels belonging to the feature-defined group," as described at page 3, lines 18–24, page 4, lines 18–25, page 10, lines 19–25, and Figure 4 of Appellant's Specification. App. Br. 9 (citing Noy Fig. 1; Spec. 10:19–25, Fig. 4); Reply Br. 2–3 (citing Noy 5:26–30; Spec. 3:18–24, 4:18–25).

The Examiner responds that Noy separates pixels belonging to a feature-defined group from other image frame pixels because Noy's Figure 4C separates normal features 52–60 from non-normal or defect features 62–64. Ans. 6 (citing Noy 4:17–32; Fig. 1, Fig. 4C, images 52–64). The Examiner then finds Noy's Figure 4C illustrates "pixel groups to be inspected (i.e. all features to be inspected) have [a] *feature space* constructed" as a *multi-dimensional feature space* representative of respective strengths of features in defective and non-defective image portions. Ans. 7 (citing Noy 6:66–7:3; Fig. 4C) (emphasis added). The Examiner then concludes Noy's multi-dimensional feature space teaches the claimed multi-dimensional feature distribution. Ans. 7.

We disagree with the Examiner. Anticipation under 35 U.S.C. § 102 is a question of fact. *Brown v. 3M*, 265 F.3d 1349, 1351 (Fed. Cir. 2001). A

claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). As discussed *supra*, Appellant's claims 1, 10, and 19 expressly require "generat[ing] a multi-dimensional feature distribution for *only pixels* belonging to *the feature-defined group of pixels*," where the feature-defined group is separately obtained by separating certain pixels in the image frame "from other pixels in the image frame that do not belong to the feature-defined group of pixels." App. Br. 14, 16, 18 (emphasis added). Appellant's Specification further describes an exemplary feature-defined group including pixels from an image frame's vertical lines, but not including pixels from the frame's horizontal line segments and open spaces. Spec. 7:9–14. The Specification then describes a multi-dimensional feature distribution generated for only the pixels belonging to this feature-defined group of vertical lines. Spec. 7:15–17, 10:19–25. According to Appellant's Specification:

> The feature distribution plot **300** in FIG. 3 is generated from all pixels in the image frame **200**. . . .
>
> *In contrast, the feature distribution plot **400** in FIG. 4 is generated from only pixels of the vertical lines **202** in the image frame **200***. . . . The normal cluster **402** in FIG. 4 is substantially smaller (tighter) than the normal cluster **302** in FIG. 3. In this case, the point **404** which has associated with it pixels which are actually defective is outside the normal cluster **402**. Hence, in this feature distribution **400**, the point **404** is identifiable as an outlier.

Spec. 10:13–25 (emphasis added). Appellant's multi-dimensional feature distribution generated for only pixels belonging to a feature-defined group enables defect detection, as explained in the Specification:

> [T]his technique is advantageous in that it allows for the detection of defects which are not detected previously. This is because the previously un-detected defects were embedded in the "noise" around the normal cluster based upon all pixels in a frame. *In contrast, these defects become detectable outliers when the normal cluster is based upon pixels in a selected feature-defined group. This is because when a separate distribution plot is created for a separate group of pixels, the noise attributable to the non-selected groups is effectively removed from the plot.*

Spec. 4:18–25 (emphasis added).

In light of Appellant's Specification, Appellant's claimed "feature-defined group of pixels" is distinctly obtained from the "multi-dimensional feature distribution." Reply Br. 2–3 (citing Spec. 3:18–24; Figs. 3–4). That is, the claimed "multi-dimensional feature distribution" is generated "for *only pixels belonging to the feature-defined group of pixels"* and not for "other pixels in the image frame that do not belong to the feature-defined group of pixels." App. Br. 14, 16, 18 (emphasis added); Reply Br. 3 (citing Spec. 4:18–25). In contrast, Noy's multi-dimensional "feature space is spanned *by all the possible values* for the collection of features representing an image portion." Reply Br. 2 (citing Noy 5:26–30) (emphasis added).

Thus, while the group of non-defect features 52–60, or the separate group of defect features 62–64 of an image frame disclosed by Noy's Figure 4C can be considered as Appellant's claimed "feature-defined group of pixels" (*see* Ans. 6), Noy does not generate a multi-dimensional feature distribution for *only* pixels of one of these groups. Rather, Noy's *multi-dimensional feature space* is generated for pixels belonging to *all* groups 52–64. *See* Noy 7:65–8:10 ("images **52-64** are generally arbitrarily plotted in a two-dimensional image space such that knowledge base **50** can be thought of as *feature space* . . . [of] multi-dimensional nature" having "*a*

portion of the feature space associated with images in knowledge base **50** that correspond to defects, and *a portion of the feature space* associated with images that correspond to non-defects" (emphases added)). Thus, Noy does not generate a multi-dimensional feature distribution for only pixels belonging to a feature-defined group, as recited in claims 1, 10, and 19.

We additionally note, while Noy discloses defects 62–64 and non-defects 52–60 (*see* Ans. 8), Noy's defects and non-defects 52–64 do not teach a normal cluster or outlier points in a multi-dimensional feature distribution, as claimed. App. Br. 10–11. Appellant's claims 1, 10, and 19 determine the normal cluster and outlier points in a particular type of distribution—the multi-dimensional feature distribution generated for only the pixels belonging to a feature-defined group—so as to identify pixels that are considered to be normal and not defective, and pixels that may be deemed defective. Reply Br. 4. In contrast to Appellant's claims 1, 10, and 19, Noy separates an image frame into defects and non-defects, without restriction to pixels of a feature-defined group. *See* Noy Figs. 4C–4D.

For these reasons, we agree with Appellant that Noy does not anticipate all the limitations of independent claims 1, 10, and 19. Accordingly, we do not sustain the Examiner's rejection of claims 1, 10, and 19, and their dependent claims 4–9, 13–18, and 20.

CONCLUSION

On the record before us, we conclude Appellant has demonstrated the Examiner erred in rejecting claims 1, 4–10, and 13–20 under 35 U.S.C. § 102(e).

DECISION

As such, we REVERSE the Examiner's final rejection of claims 1, 4–10, and 13–20.

REVERSED